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(54) BROMINATED POLYSTYRENE FOR FLAME RETARDANT AND FLAME-RETARDANT RESIN COMPOSITION CONTAINING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a brominated polystyrene for a flame retardant which gives a flame-retardant resin compsn. having a greatly improved processibility while retaining mechanical properties unobtainable with a conventional flame retardant by specifying the mol.wt. and to provide a flame retardant resin compsn. contg. the same.

SOLUTION: This brominated polystyrene for a flame retardant has a wt. average mol.wt. of 5,000-15,000 and, when compounded with a synthetic resin, gives a flame-retardant resin compsn. Usually 100 pts.wt. synthetic resin is compounded with 5-50 pts.wt. this brominated polystyrene. A flame-retardant resin compsn. exhibiting flame-retardant properties and nondripping properties is obtd. e.g. by compounding 100 pts.wt. synthetic resin with 5-200 pts.wt. this brominated polystyrene, 5-200 pts.wt. glass fibers, 1-140 pts.wt. antimony trioxide or sodium antimonate, and 0.1-10 pts.wt. emulsion-polymn. Teflon.

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CLAIMS

[Claim(s)]

[Claim 1] Bromination polystyrene for flame retarders characterized by weight average molecular weight being 5,000-15,000 in polystyrene conversion.

[Claim 2] The flame-retardant-resin constituent characterized by consisting of the bromination polystyrene for flame retarders according to claim 1 and synthetic resin.

[Claim 3] The flame-retardant-resin constituent according to claim 2 characterized by consisting the bromination polystyrene for flame retarders according to claim 1 of the 5 - 50 weight section to the synthetic-resin 100 weight section.

[Claim 4] The flame-retardant-resin constituent according to claim 2 characterized by consisting the bromination polystyrene for flame retarders according to claim 1 of the 5 - 200 weight section, and consisting [glass fiber] the 1 - 140 weight section and emulsion-polymerization Teflon of the 0.1 - 10 weight section in the 5 - 200 weight section, an antimony trioxide, or sodium antimonsate to the synthetic-resin 100 weight section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] The constituent which consists of bromination polystyrene for flame retarders of this invention and it about the constituent with which this invention consists of bromination polystyrene for flame retarders and it is usable also as a combination mold flame retarder for fire-resistant resin used abundantly at various electric products etc. while it raises workability sharply and is a compound useful to flameproofing of synthetic resin, without reducing machine physical properties.

[0002]

[Description of the Prior Art] As flameproofing of conventional synthetic resin, to various resin, various bromine system flame retarders, a phosphoric ester system flame retarder, an inorganic flame retardant, etc. are used, and proper use is made by the application. As a typical flame retarder, they are deca BUROMO diphenyloxide and a tetra-BUROBISU phenol. - A (it omits Following TBA) and TBA-epoxy oligomer, a magnesium hydroxide, an aluminum hydroxide, etc. are raised. Moreover, although bromination polystyrene and its process are indicated by JP,56-127876,A, they have the problem that machine physical properties, workability, etc. fall according to the class of resin to blend.

[0003] Thus, although the proposal of various flame retarders is made and proper use is made for various applications, strengthening of fire-resistant regulation in recent years and the further improvement demand of the engine performance of the blended fire-resistant resin are high, and an invention of ** which complements the fault of elegance conventionally is desired.

[0004]

[Problem(s) to be Solved by the Invention] In the conventional flame retarder, the purpose of this invention maintains the machine physical properties which were not acquired, and offers the constituent which consists of the bromination polystyrene for flame retarders and it which raised workability sharply.

[0005]

[Means for Solving the Problem] this invention persons came to complete this invention, as a result of inquiring wholeheartedly based on such a background. That is, this invention relates to the flame-retardant-resin constituent with which weight average molecular weight consists of bromination polystyrene for flame retarders of 5,000-15,000, and it by polystyrene conversion.

[0006] Hereafter, this invention is explained to a detail.

[0007] Although the bromination polystyrene for flame retarders of this invention is not limited especially if polystyrene equivalent weight average molecular weight is 5,000-15,000, it is still more desirable that 5% weight loss in quantity [/ content / for example, / bromine] according [softening temperature] to 150-250 degrees C and thermobalance measurement is the white - light yellow powder in which the thermal resistance of 300 degrees C or more is shown 40 to 70% of the weight.

[0008] In the case of less than 5,000, the heat-resistant deformation temperature of a constituent may fall [the weight average molecular weight of the bromination polystyrene for flame retarders obtained] sharply by polystyrene conversion, and the physical properties demanded may not be satisfied. On the other hand, when exceeding 15,000, it is inferior to the fabrication nature of a constituent, and shock resistance falls.

[0009] Especially manufacture of the bromination polystyrene for flame retarders of this invention is not limited, and is usually carried out by the approach of making dissolve the polystyrene of a raw material in a solvent inactive for a reaction under catalyst existence, for example, trickling a bromination agent into this.

[0010] Although all things can be applied and the class of chain transfer agent usually has thiol systems, such as

halogen systems, such as a carbon tetrachloride, and butyl mercaptan, an alpha-methyl-styrene dimer, etc. that the polystyrene used for this invention should just be weight average molecular weight 5,000-15,000 if obtained by the polymerization reaction under the chain transfer agent existence of a styrene monomer, it is not specified especially. As a polymerization method of polystyrene, a radical polymerization, anionic polymerization, cationic polymerization, etc. are mentioned, and all the polystyrene obtained according to solution polymerization, an emulsion polymerization, a suspension polymerization, etc. can apply as a raw material of this invention as a reaction gestalt, for example.

[0011] as a catalyst applicable to manufacture of the bromination polystyrene for flame retarders of this invention -- an aluminum chloride, the aluminium bromide, a ferric chloride, and bromination -- these catalysts are chosen with the second iron, a titanium tetrachloride, a titanium trichloride, an antimony pentachloride, an antimony trichloride, and the number of nuclear bromination that antimony, tin chloride, trifluoro borane ETERATO, etc. are raised 3 bromination, and is made into the purpose. Moreover, even if it mixes and uses that these catalysts are independent or two sorts or more, it is convenient in any way.

[0012] When it can add in all the amount and reactivity, economical efficiency, etc. are taken into consideration to the styrene unit unit which constitutes the polystyrene possessed for a reaction as an addition of a catalyst, the range of 0.01-mol [/mol] % - 100-mol [/mol] % is desirable. It is the range of 0.1-mol [/mol] % - 30-mol [/mol] % still more preferably.

[0013] or [using properly according to the target quality of the number of nuclear bromination which especially a bromination agent applicable to this invention does not limit, and are a bromine, a bromine chloride, etc., for example, is made into the purpose, the catalyst to be used, and the bromination styrene for flame retarders obtained] -- or it is mixed and used.

[0014] A bromination agent here shows the generic name of the agent which adds a bromine atom to unsaturated bonds, such as a hydrogen atom of a common organic compound or an agent which permutes a substituent by the bromine atom, and an olefin, in addition to this. Moreover, the number of nuclear bromination shows the number of the bromine atom combined on the ring of the styrene unit unit which forms polystyrene.

[0015] As an addition of a bromination agent, it changes with the number of nuclear bromination of the unit unit of the bromination styrene made into the purpose. Usually, although molar quantity is used an equimolecular amount - 5 times to the target number of nuclear bromination, preferably, it is the range of this molar quantity - 1.5 time molar quantity, and the amount of the bromination agent used is decided by the class of catalyst to be used, and the reaction condition.

[0016] As a solvent used for a reaction, if inactive for a bromination agent and a catalyst, all things can be applied, for example, dichloromethane, dibromomethane, chloroform, bromoform, a carbon tetrachloride, etc. will be raised.

[0017] Although it is applicable by all quantitative ratios as amount of the solvent used to the polystyrene 100 weight section possessed for a reaction, it is the range of the 120 weight sections - 8000 weight section preferably from reaction mixture viscosity and economical efficiency.

[0018] Although it changes as reaction temperature with whenever [nuclear bromination / which is made into a bromination agent, a catalyst, and the purpose], when using a bromine, it usually carries out at -30 degrees C - 20 degrees C by 0 degree C - 60 degrees C, the bromine chloride or the bromine, and the bromine chloride concomitant use system.

[0019] Especially if the drop time of a bromination agent is under the condition which this reaction is exothermic reaction and the hydrogen chloride gas which control of reaction temperature is possible and occurs since it is accompanied by generating of hydrogen chloride gas can catch out of a system, it will not be limited. After bromination agent addition, after treatment may be performed immediately and aging may be performed at predetermined temperature for 1 to 8 hours.

[0020] An excessive bromination agent is eliminated by adding reducing agents, such as a hydrazine and a sodium hydrogensulfite, etc. after reaction termination, and, subsequently to poor solvents, such as rinsing and a methanol, the bromination polystyrene of the specified substance is obtained as white - light yellow powder by carrying out addition crystallization and carrying out filtration, desiccation, etc. further, for example.

[0021] The constituent which consists of bromination polystyrene for flame retarders of this invention may add additives, such as an ultraviolet ray absorbent, light stabilizer, an antioxidant, an antistatic agent, and an inorganic bulking agent, to the bromination polystyrene for flame retarders further if needed that what is necessary is just to add synthetic resin, for example, thermosetting resin, thermoplastics, a fire-resistant assistant, etc.

[0022] As synthetic resin which can be blended with the bromination polystyrene for flame retarders of this invention For example, phenol resin, a urea resin, melamine resin, unsaturated polyester, Thermosetting resin, such as alkyd resin and an epoxy resin, low density polyethylene and ethylene-vinyl acetate copolymer,

polystyrene, High impact polystyrene, form polystyrene, an acrylonitrile styrene copolymer, Acrylonitrile-butadiene-styrene copolymer (it omits Following ABS), Thermoplastics, such as polypropylene, petroleum resin, polymethylmethacrylate, a polyamide, a polycarbonate, polyacetal, polyethylene terephthalate, polybutylene terephthalate, and polyphenylene ether, etc. is mentioned. As synthetic resin which pulls out more the description of the bromination polystyrene for flame retarders of this invention Polystyrene, high impact polystyrene, form polystyrene, an acrylonitrile styrene copolymer, An acrylonitrile-styrene-butadiene copolymer, polypropylene, Petroleum resin, polymethylmethacrylate, a polyamide, a polycarbonate, Polyacetal, polyethylene terephthalate, polybutylene terephthalate, Polyphenylene ether etc. is mentioned and the polymer alloy further represented by polycarbonate-ABS which mixed two or more kinds of thermoplastics, polyphenylene ether-polystyrene, etc. is mentioned.

[0023] Although it changes with fire-resistant engine performance made into the class of resin to blend, and the purpose as loadings to the synthetic resin of the bromination polystyrene for flame retarders of this invention, 5 weight sections -50 weight section addition is usually carried out to the resin 100 weight section.

[0024] In blending the bromination polystyrene for flame retarders of this invention with synthetic resin, fire-resistant assistants, such as an antimony trioxide and sodium antimonate, etc. may be added, and it is [as opposed to / usually / the bromination polystyrene 100 weight section for flame retarders] **** for 10 weight sections - 80 weight sections. Moreover, the light stabilizer of the ultraviolet ray absorbent of a benzotriazol system, 2, 2 and 6, and 6-tetramethylpiperidine derivative, the antioxidant of a hindered phenol system, etc. may be added if needed 0.05 % of the weight to 5% of the weight, respectively. In addition, inorganic bulking agents, such as an antistatic agent, talc, and glass fiber, may be added if needed.

[0025] furthermore -- although it changes with classes of synthetic resin in order to obtain the flame-retardant-resin constituent which has fire retardancy and non drip nature (property in which a drop is not generated at the time of combustion) -- usually -- the synthetic-resin 100 weight section -- receiving -- the bromination polystyrene for flame retarders -- the 5 - 200 weight section and glass fiber -- as the 5 - 200 weight section and a drip inhibitor -- emulsion-polymerization Teflon -- as 0.1 - 10 weight section and a fire-resistant assistant -- an antimony trioxide -- or what is necessary is just to carry out sodium antimonate 1-140 weight section combination That what is necessary is just to use a class and an amount properly by the physical properties of the constituent made into the purpose, and the drip control degree, if the bromination polystyrene for flame retarders is used, workability of the class of glass fiber and emulsion-polymerization Teflon will improve.

[0026] That what is necessary is just to carry out postcure, when [which is blended with thermoplastics] blending with thermosetting resin and a resin raw material is beforehand distributed as the combination approach to the synthetic resin of the bromination polystyrene for flame retarders of this invention, a required combination agent may be mixed using a conical blender and tumbler mixer etc., and you may PERENTO-ize using a twin screw extruder etc., and may pelletize after melting mixing using a twin screw extruder etc. with a Banbury mixer, a pressurized kneader, etc. especially the processing approach of the bromination polystyrene constituent for these profit **** flame retarders is not limited, extrusion molding, injection molding, etc. can be performed, for example, the target mold goods can be obtained.

[0027]

[Example] Hereafter, although an example explains this invention concretely, this invention is not limited only to these examples.

[0028] Example 1 of manufacture 5 which the number of nuclear bromination equipped with the example agitator of manufacture and the dropping funnel with a cooling jacket of the bromination polystyrene for flame retarders of 3 Weight average molecular weight taught polystyrene 100g [of 1.05×10^4], 21.9g [of antimony trichlorides], and dichloromethane 1000g to 3 opening round bottom flask of 1 by polystyrene conversion, and it cooled at 0 degree C on the ice bath.

[0029] Subsequently, after it taught the dichloromethane solution containing 355g of bromine chlorides prepared from 246g [of bromines], 109g [of chlorine], and dichloromethane 900g to the cooling jacket and 0 degree C cooled at 5 degrees C, aging was performed for this to dropping and a pan at this temperature over 6 hours for 3 hours.

[0030] 150g of hydrazine water solutions was added 5% to the obtained reaction mixture, liquids were washed and separated 3 times with 500ml water after eliminating a bromine chloride, and bromination polystyrene 255g for flame retarders which is made to carry out crystallization, and is made into the purpose by subsequently adding to agitated isopropanol 5l. when filtration and 1mmHg dry for bottom 120-degree-Cof reduced pressure x 4 hours was obtained.

[0031] The result of the elemental analysis of the obtained bromination polystyrene for flame retarders, softening temperature, a gel permeation chromatograph (GPC), and thermobalance measurement is shown below.

[0032]

Elemental-analysis result : C H Br Cl Measured value (% of the weight) 31.4 1.8 67.5 0.6 softening temperature (degree C) : A 200 - 203 gel-permeation chromatograph : Weight-average-molecular-weight (Mw) = 1.12×10^4 , (number-average-molecular-weight Mn) = 6.18×10^3 , weight-average-molecular-weight (Mw) / (number-average-molecular-weight Mn) =1.81 thermobalance (programming rate: 10-degree-C / min):5% loss in quantity (337 degrees C), 10% loss in quantity (353 degrees C), (GPC) 50% loss in quantity (390 degrees C), 90% loss in quantity (502 degrees C)

Example 2 of manufacture 5 which the number of nuclear bromination equipped with the example agitator of manufacture and the dropping funnel with a cooling jacket of the bromination polystyrene for flame retarders of 3 Weight average molecular weight taught polystyrene 100g [of 2.94×10^4], 21.9g [of antimony trichlorides], and dichloromethane 1200g to 3 opening round bottom flask of 1 by polystyrene conversion, and it cooled at 0 degree C on the ice bath.

[0033] Subsequently, after it taught the dichloromethane solution containing 375g of bromine chlorides prepared from 246g [of bromines], 115g [of chlorine], and dichloromethane 900g to the cooling jacket and 0 degree C cooled at 5 degrees C, aging was performed for this to dropping and a pan at this temperature over 6 hours for 3 hours.

[0034] 158g of hydrazine water solutions was added 5% to the obtained reaction mixture, liquids were washed and separated 3 times with 500ml water after eliminating a bromine chloride, and bromination polystyrene 257g for flame retarders which is made to carry out crystallization, and is made into the purpose by subsequently adding to agitated isopropanol 5l. when filtration and 1mmHg dry for bottom 120-degree-C of reduced pressure x 4 hours was obtained.

[0035] The result of the elemental analysis of the obtained bromination polystyrene for flame retarders, softening temperature, a gel permeation chromatograph (GPC), and thermobalance measurement is shown below.

[0036]

Elemental-analysis result : C H Br Cl Measured value (% of the weight) 30.0 1.8 67.6 0.8 softening temperature (degree C) : A 220 - 225 gel-permeation chromatograph : Weight-average-molecular-weight (Mw) = 3.02×10^4 , (number-average-molecular-weight Mn) = 1.45×10^4 , weight-average-molecular-weight (Mw) / (number-average-molecular-weight Mn) =2.08 thermobalance (programming rate: 10-degree-C / min):5% loss in quantity (339 degrees C), 10% loss in quantity (350 degrees C), (GPC) 50% loss in quantity (387 degrees C), 90% loss in quantity (505 degrees C)

The obtained bromination polystyrene for flame retarders performed an inflammable trial, workability (fluidity), shock resistance, the tension test, the bending test, etc. by the approach shown below.

[0037] Creating the piece of a sample blank test obtained from the <evaluation approach of inflammable trial> injection molding, the oxygen index measured UL combustion test based on the UV94V perpendicular flammability test method based on JIS-K -7201, respectively.

[0038] Based on JIS-K -6760, the melt flow rate (275 degree-Cx325g) was measured using the pellet <evaluation approach of workability (fluidity)> Obtained.

[0039] The piece of a sample blank test obtained by <shock-proof> injection molding was created, and Izod impact value was measured based on ASTM-D -256.

[0040] From the sample obtained by <tension test> injection molding, it pierced by the No. 3 dumbbell, considered as the test piece, and measured by part for speed-of-testing/of 200mm.

[0041] The piece of a sample blank test obtained by <bending test> injection molding was created, and it measured based on JIS-K -7203.

[0042] the bromination polystyrene for flame retarders obtained in the example 1 of manufacture as shown in example 1 table 1 -- the 6 and 6-nylon (Toray Industries Amilan CM 3001) 100 weight section -- receiving -- 30 weight sections -- antimony-trioxide 10 weight section combination was carried out, it kneaded at 270-280 degrees C using the biaxial extruder (ratio-of-length-to-diameter:25), and the pellet was made. Injection molding was carried out using this pellet with the melting temperature of 280-285 degrees C, and the die temperature of 80 degrees C. From these samples, the test piece for workability (fluidity), shock resistance, a tension test, a bending test, and an inflammable trial was created and evaluated [measured and]. The result was shown in Table 1.

[0043] It was what can satisfy workability (fluidity), shock resistance, a tension test, a bending test, and an inflammable trial.

[0044] moreover, 6 and 6-nylon (Toray Industries Amilan CM 3001) -- various independent evaluation results were also shown in Table 1.

[0045]

[Table 1]

<配合組成(重量部)>	実施例1	実施例2	比較例1	比較例2	比較例3	比較例4	参考
6,6-ナイロン 製造例1の臭素化ポリスチレン 製造例2の臭素化ポリスチレン 市販の臭素化ポリスチレン 三酸化アンチモン	100 30 — — 10	100 15 — — 5	100 — — 30 10	100 — 30 — 10	100 — — 15 5	100 — 15 — 5	100 — — — —
加工性(流動性) MFR ¹⁾	13.9	10.1	8.75	9.42	9.51	9.57	8.90
耐衝撃性 ²⁾ (kgf·cm/cm ²)	2.93	2.99	2.93	2.93	3.18	3.07	4.72
引張試験 降伏強さ (kgf/cm ²) 破壊強さ (kgf/cm ²) 伸び率 (%)	— 842 7.0	888 660 22.0	739 730 4.4	— 786 5.2	773 759 6.8	831 782 10.6	846 654 51.2
曲げ試験 曲げ弾性率 (kgf/cm ²) 曲げ強さ (kgf/cm ²)	34100 1270	32600 1250	33000 1150	33500 1180	32200 1170	32600 1200	29600 1190
燃焼性試験 酸素指数 ³⁾ UL-94V燃焼性 ⁴⁾ 1/16インチ 1/32インチ	37.3		38.2	37.3	25.0	25.0	18.5
V0 V0		V0 V0	V0 V0	V0 V2	V0 V2	V0 HB	HB

1) メルトフローレート (MFR) 条件: 275°C, 0.325 kg

2) アイソット衝撃値

3) 酸素指数 : スガ試験機製 ON-1型

4) UL94V燃焼性試験 : スガ試験機製 UL-94V型

[0046] the bromination polystyrene (weight average molecular weight is 1.12×10^4 by polystyrene conversion) 15 weight section for flame retarders obtained in the example 1 of manufacture as shown in example 2 table 1 -- antimony-trioxide 5 weight section combination was carried out, and also it carried out like the example 1, and the test piece for workability (fluidity), shock resistance, a tension test, and bending tests was created and evaluated [measured and].

[0047] The result was shown in Table 1.

[0048] It was what can satisfy workability (fluidity), shock resistance, a tension test, and a bending test.

[0049] as being shown in example of comparison 1 table 1 -- the bromination polystyrene of marketing of weight average molecular weight of 200,000 by polystyrene conversion -- the 6 and 6-nylon (Toray Industries Amilan CM 3001) 100 weight section -- receiving -- 30 weight sections -- antimony-trioxide 10 weight section combination was carried out, and also it carried out like the example 1, and the test piece for workability (fluidity), shock resistance, a tension test, a bending test, and an inflammable trial was created and evaluated [measured and]. The result was shown in Table 1.

[0050] Workability (fluidity) was inferior although shock resistance, the tension test, the bending test, and the inflammable trial were satisfied so so.

[0051] the bromination polystyrene for flame retarders (weight average molecular weight is 3.02×10^4 by polystyrene conversion) obtained in the example 2 of manufacture as shown in example of comparison 2 table 1 -- the 6 and 6-nylon (Toray Industries Amilan CM 3001) 100 weight section -- receiving -- 30 weight sections -- antimony-trioxide 10 weight section combination was carried out, and also it carried out like the example 1, and the test piece for workability (fluidity), shock resistance, a tension test, a bending test, and an inflammable trial was created and evaluated [measured and].

[0052] The result was shown in Table 1.

[0053] Workability (fluidity) was inferior although shock resistance, the tension test, the bending test, and the inflammable trial were satisfied so so.

[0054] as being shown in example of comparison 3 table 1 -- the bromination polystyrene 15 weight section of marketing of weight average molecular weight of 200,000 by polystyrene conversion -- antimony-trioxide 5 weight section combination was carried out, and also it carried out like the example 1, and the test piece for workability (fluidity), shock resistance, a tension test, and bending tests was created and evaluated [measured and]. The result was shown in Table 1.

[0055] Workability (fluidity) was inferior although shock resistance, the tension test, and the bending test were satisfied so so.

[0056] the bromination polystyrene (weight average molecular weight is 3.02×10^4 by polystyrene conversion) 15 weight section for flame retarders obtained in the example 2 of manufacture as shown in example of comparison 4 table 1 -- antimony-trioxide 5 weight section combination was carried out, and also it carried out like the example 1, and the test piece for workability (fluidity), shock resistance, a tension test, and bending tests was created and

evaluated [measured and].

[0057] The result was shown in Table 1.

[0058] Workability (fluidity) was inferior although shock resistance, the tension test, and the bending test were satisfied.

[0059] The bromination for flame retarders obtained by the same process as the example 1 of manufacture as shown in an example 3 and the example 5 of a comparison, and six table 2 (weight average molecular weight is 1.12×10^4 by police CHINREN conversion), The 6 and 6-nylon (Toray Industries Amilan CM 3301) 100 weight section is received in the dibromo styrene polymer of marketing of the bromination polystyrene and molecular weight of marketing of molecular weight 200,000 of 50,000., respectively The 32.3 weight sections, The antimony-trioxide 16.1 weight section, the glass fiber (GURASURON chopped strand 03MA made from Asahi glass fiber 419) 64.5 weight section, emulsion-polymerization Teflon (Asahi-ICI Fluoropolymers FLUONCD4) 2.2 weight section combination -- carrying out -- a biaxial extruder (ratio-of-length-to-diameter:25) -- using -- 270-280 degrees C -- kneading -- a pellet -- it each produced. Injection molding was performed using these pellets with the melting temperature of 280-285 degrees C, and the die temperature of 80 degrees C. From these samples, workability (fluidity), shock resistance, the tension test, the bending test, and the inflammable test piece were produced, and it measured and evaluated, respectively. The result was shown in Table 2.

[0060] Inflammable ability and workability (fluidity) surpassed the bromination polystyrene for flame retarders of this invention as compared with other commercial agents.

[0061] Moreover, it is glass fiber (GURASURON chopped strand 03MA made from the Asahi glass fiber 419) to the 6 and 6-nylon (Toray Industries Amilan CM 3001) 100 weight section. The various evaluation results of the strengthening article which carried out 42.9 weight sections combination were also shown in Table 2.

[0062]

[Table 2]

<配合組成(重量部)>	実施例3	比較例5	比較例6	参考
6, 6-ナイロン	100	100	100	100
グラスファイバー	64.5	64.5	64.5	42.9
製造例1の臭素化ポリスチレン	32.3	—	—	—
市販の臭素化ポリスチレン	—	32.3	—	—
市販のジプロモスチレンポリマー	—	—	32.3	—
三酸化アンチモン	16.1	16.1	16.1	—
乳化重合テフロン	2.2	2.2	2.2	—
加工性(流动性) MFR ¹⁾	3.1	1.2	2.3	1.0
耐衝撃性 ²⁾ (kgf·cm/cm ²)	7.5	7.2	6.8	12.4
引張試験				
降伏強さ (kgf/cm ²)	—	—	—	—
破壊強さ (kgf/cm ²)	1350	1370	1270	1473
伸び率 (%)	6.0	4.0	4.5	7.2
曲げ試験				
曲げ弾性率 (kgf/cm ²)	98400	97200	98300	104300
曲げ強さ (kgf/cm ²)	2080	2080	1970	2100
燃焼性試験				
酸素指数 ³⁾	32.9	32.0	31.6	
UL-94 V燃焼性 ⁴⁾	V0	V1	V1	
1/16インチ	V0	V1	V1	
1/32インチ	V0	V1	V1	

1) メルトフローレート (MFR) 条件: 275°C, 2.16 kg

2) アイソット衝撃値

3) 酸素指数 : スガ試験機製 ON-1型

4) UL 94 V燃焼性試験 : スガ試験機製 UL-94 V型

[0063] The bromination for flame retarders obtained by the same process as the example 1 of manufacture as shown in an example 4 and the example 7 of a comparison, and eight table 3 (weight average molecular weight is 1.12×10^4 by police CHINREN conversion), It is polybutylene terephthalate (it omits Following PBT) about the bromination polystyrene of marketing of molecular weight 200,000, and the tetrabromobisphenol A phenoxy resin of marketing of molecular weight of 20,000. the Mitsubishi Chemical nova DOURU 5010 100 weight section -- receiving -- respectively -- 20 weight sections and antimony-trioxide 4 weight section combination -- carrying out -- a biaxial extruder (ratio-of-length-to-diameter:25) -- using -- 240-250 degrees C -- kneading -- a pellet -- it each produced. Injection molding was performed using these pellets with the melting temperature of 265-275 degrees C, and the die temperature of 80 degrees C. From these samples, workability (fluidity), shock resistance, the tension test, the bending test, and the inflammable test piece were produced, and it measured and evaluated, respectively. The result was shown in Table 3.

[0064] Inflammable ability and workability (fluidity) surpassed the bromination polystyrene for flame retarders of this invention as compared with other commercial agents.

[0065] Moreover, the various evaluation results of PBT (Mitsubishi Chemical nova DOURU 5010) were also shown in Table 3.

[0066]

[Table 3]

<配合組成(重量部)>	実施例4	比較例7	比較例8	参考
P B T	1 0 0	1 0 0	1 0 0	1 0 0
製造例1の臭素化ポリスチレン	2 0	—	—	—
市販の臭素化ポリスチレン	—	2 0	—	—
市販のテトラブロモビスフェノールA	—	—	2 0	—
フェノキシ樹脂				
三酸化アンチモン	4	4	4	—
加工性(流動性) M F R ^{①)}	2 9	1 4	1 5	1 2
耐衝撃性 ^{②)} (kgf/cm ²)	3. 0	2. 5	3. 1	4. 7
引張試験				
降伏強さ (kgf/cm ²)	—	—	—	—
破壊強さ (kgf/cm ²)	6 2 9	6 4 0	6 5 6	1 4 7 3
伸び率 (%)	6. 0	2. 0	8. 5	2 3 0
曲げ試験				
曲げ弾性率 (kgf/cm ²)	2 8 8 0 0	2 7 9 0 0	2 8 6 0 0	2 2 5 0 0
曲げ強さ (kgf/cm ²)	9 8 2	8 6 3	9 4 3	7 6 6
燃焼性試験				
酸素指数 ^{③)}	3 1. 6	2 9. 4	2 8. 9	
UL-94 V燃焼性 ^{④)}	V 0	V 2	V 2	
1/16インチ	V 0	V 2	V 2	
1/32インチ				

1) メルトフローレート(MFR) 条件: 235°C, 2. 16 kg

2) アイソット衝撃値

3) 酸素指数 : スガ試験機型 ON-1型

4) UL 94 V燃焼性試験 : スガ試験機型 UL-94 V型

[0067] The bromination for flame retarders obtained by the same process as the example 1 of manufacture as shown in an example 5 and the example 8 of a comparison, and nine table 4 (weight average molecular weight is 1.12x104 by police CHINREN conversion), The PBT(Mitsubishi Chemical nova DOURU 5010) 100 weight section is received in the bromination polystyrene of marketing of molecular weight 200,000, and the tetrabromobisphenol A phenoxy resin of marketing of molecular weight of 20,000. Respectively The 15.8 weight sections, the antimony-trioxide 5.3 weight section, the glass fiber (GURASURON chopped strand 03MA made from Asahi glass fiber 419) 52.6 weight section, emulsion-polymerization Teflon (Asahi-ICI Fluoropolymers FLUONCD4) 1.8 weight section combination -- carrying out -- a biaxial extruder (ratio-of-length-to-diameter:25) -- using -- 240-250 degrees C -- kneading -- a pellet -- it each produced. Injection molding was performed using these pellets with the melting temperature of 265-275 degrees C, and the die temperature of 80 degrees C. From these samples, workability (fluidity), shock resistance, the tension test, the bending test, and the inflammable test piece were produced, and it measured and evaluated, respectively. The result was shown in Table 4.

[0068] Workability (fluidity) surpassed the bromination polystyrene for flame retarders of this invention as compared with other commercial agents, and the fire-resistant engine performance was surpassed at commercial tetrabromobisphenol A phenoxy resin.

[0069] Moreover, it is glass fiber (GURASURON chopped strand 03MA made from the Asahi glass fiber 419) to the PBT(Mitsubishi Chemical nova DOURU 5010) 100 weight section. The various evaluation results of the strengthening article which carried out 70.6 weight sections combination were also shown in Table 4.

[0070]

[Table 4]

<配合組成(重量部)>	実施例5	比較例9	比較例10	参考
PBT	100	100	100	100
グラスファイバー	52.6	52.6	52.6	42.9
製造例1の臭素化ポリスチレン	15.8	—	—	—
市販の臭素化ポリスチレン	—	15.8	—	—
市販のテトラブロモビスフェノールA	—	—	15.8	—
フェノキシ樹脂	—	—	—	—
三酸化アンチモン	5.3	5.3	5.3	—
乳化重合テフロン	1.8	1.8	1.8	—
加工性(流动性) MFR ¹⁾	7.03	3.46	3.56	3.94
耐衝撃性 ²⁾ (kgf/cm ²)	5.7	5.8	5.7	10.3
引張試験				
降伏強さ (kgf/cm ²)	—	—	—	—
破壊強さ (kgf/cm ²)	1184	1144	1214	1364
伸び率 (%)	2.5	2.3	2.5	3.2
曲げ試験				
曲げ弾性率 (kgf/cm ²)	94980	93050	93920	87080
曲げ強さ (kgf/cm ²)	1903	1843	1920	2100
燃焼性試験				
酸素指数 ³⁾	27.2	27.2	26.8	
UL-94 V燃焼性 ⁴⁾	V0	V0	V2	
1/16インチ	V0	V0	V2	
1/32インチ				

1) メルトフロー率 (MFR) 条件: 235°C, 2.16kg

2) アイソット衝撃値

3) 酸素指数 : スガ試験機製 ON-1型

4) UL-94 V燃焼性試験: スガ試験機製 UL-94 V型

[0071]

[Effect of the Invention] The flame-retardant-resin constituent which consists of bromination polystyrene for flame retarders of this invention and it raises workability sharply, without reducing machine physical properties, and is useful as a flame retarder of synthetic resin, and usable as a combination mold flame retarder for fire-resistant resin used abundantly at various electric products etc.

[Translation done.]